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ABSTRACT

Three investigations examined the effects of IQ and chronological age (CA) on the calculation of severe discrepancy levels of 102 hypothetical and 125 actual severely learning disabled students (5 to 17 years old). Results indicated that IQ was highly influential on obtained severe discrepancy levels (SDLs) and related percentage discrepancies: that CA acted more as a moderator than as a predictor of the SDL and percent discrepancy levels: and that high levels of error can be expected if the SDL is calculated without regard to its discrepant level and used as a placement or evaluation criterion against which to measure achievement differences. A formula is proposed to obtain 50% discrepancy levels at various IQ and CA levels. (CL)

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University of Minnesota

Research Report No. 7

TOWARD DEFINING DISCREPANCIES FOR SPECIFIC LEARNING DISABILITIES: AN ANALYSIS AND ALTERNATIVES

Bob Algozzine, Charles Forgnone, Cecil D. Mercer, and John J. Trifiletti

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Institute for Research on Learning Disabilities

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I. Adequacy of Norm-Referenced Data for Prediction of Success

II. Computer Simulation Research on the Assessment/Decision-making/Intervention Process

III. Comparative Research on Children Labeled LD and Children Failing Academically but not Labeled LD

IV. Surveys on In-the-Field Assessment, Decision Making, and Intervention

V. Ethological Research on Placement Team Decision Making

VI. Bias Following Assessment

VII. Reliability and Validity of Formative Evaluation Procedures

VIII. Data-Utilization Systems in Instructional Programming

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June 1979

Abstract

The United States Office of Education has indicated that the only generally accepted manifestation of a specific learning disability is that there is a significant discrepancy between expected and actual achievement. Methods for determining the significance of any achievement discrepancies in children's performances become important within this context. The research reported here attempted to evaluate the utility of two procedures for determining severe discrepancy levels; the benefits and liabilities of each are discussed.

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Toward Defining Discrepancies for Specific Learning Disabilities: An Analysis and Alternatives

Since the classic work of Strauss and Lehtinen (1947) with "brain-injured" children, numerous efforts (Clements, 1966; U.S.O.E., 1968) have been directed at defining the target population now encompassed by the term specific learning disabilities (SLD). Some of the current definitional problems are reflected in a recent survey (Mercer, Forgnone, & Wolking, 1976) which reported the use of numerous definitions by state departments of education. In addition, Mercer et al. noted that the state definitions included the use of 15 different components, with the number of components in any one definition varying from one to 11. Since 1972, two states (Florida and Washington) have developed and used specific operational criteria to identify SLD students. Moreover, school personnel in Florida have reacted favorably to the use of the operational criteria to identify SLD (Mercer, Lessen, & Algozzine, 1977). These results are consistent with Chalfant and King's (1976) position that existing definitions include components suitable for use in operational efforts.

Efforts to operationalize the criteria for determining SLD appear in line with recent legislation (Public Law 94-142) which mandates the development of a more precise definition of specific learning disabilities. The United States Office of Education (U.S.O.E., 1976) responded to this very difficult task of precisely defining a specific learning disability by selecting some definitional components and offering operational criteria. Those U.S.O.E. proposed guidelines stated that it was necessary for a child to exhibit a severe discrepancy between achievement and intellectual

ability before being classified as SLD. If a child performed at or below 50% of his or her expected achievement level "when intellectual ability, age, and previous educational experiences are considered" (U.S.O.E., 1976, p. 52407), then a severe discrepancy existed. The following formula for determining the severe discrepancy was proposed:

$$CA\ (\frac{IQ}{300} + 0.17) - 2.5 = \text{severe discrepancy level (SDL)}.$$

Response from the field was overwhelmingly negative with regard to this proposed formula; Danielson and Bauer (1978) have discussed the issues and reactions which resulted from the U.S.O.E. proposed formula for quantifying the severe discrepancy level.

The most recent attempt by the federal government to define "specific learning disability" closely parallels the guidelines established by the National Advisory Committee on Handicapped Children (NACHC) in 1968. The current definition follows:

> "Specific learning disability" means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, or emotional disturbance, or of environmental, cultural, or economic disadvantage. (U.S.O.E., 1977, p. 65083)

Although largely unchanged in definition since 1968, SLD is now evaluated differently according to the Federal Register guidelines (Mercer, 1979). While "process disorders" appear in the definition, they are overlooked in the suggested identification criteria; and, although the discrepancy notion is not included in the definition, it is the primary

aspect of the identification criteria. The Federal Register (U.S.O.E., 1977) delimits the following criteria in addition to the common exclusionary components:

> A team may determine that a child has a specific learning disability if:
>
> 1. The child does not achieve commensurate with his or her age and ability levels in one or more of the areas listed in [the] paragraph...[below]...this section, when provided with learning experiences appropriate for the child's age and ability levels; and
> 2. The team finds that a child has a severe discrepancy between achievement and intellectual ability in one or more of the following areas:
>
> Oral expression; listening comprehension; written expression; basic reading skill; reading comprehension; mathematics calculation; or mathematics reasoning. (U.S.O.E., 1977, p. 65083)

While the formula for determining "discrepancy" has disappeared, it is clearly evident that some measure of a significant difference between expected and actual achievement is needed to implement the identification procedure suggested by the government. It should be noted that the first suggested criterion defines non-achievement relative to age and ability levels; these are the two primary components which may vary in the U.S.O.E. formula. Similarly, the second criterion suggests that a "severe discrepancy" is found before identification can occur; the intent of the proposed formula was to define that discrepancy level.

In a national survey of current SLD definitions, it was found that several states have adopted the 1976 U.S.O.E. guidelines (i.e., the formula) while others have adopted the 1977 definition and criteria (Wells, Schmid, Mercer, & Algozzine, 1979). The purpose of this research was to analyze (and provide alternatives to) the U.S.O.E. formula for determining severe discrepancy levels. Such a project was seen as important, in spite of the limited support the formula received, because of the adoption in several

states of the 1976 regulations and the strong emphasis in the 1977 guidelines regarding finding a "severe discrepancy" between achievement and ability as a basis for SLD identification. If a discrepancy is necessary, it seemed appropriate to analyze and provide the best alternatives for measuring it; toward this goal, the research addressed four main issues:

1. Using the 50% discrepancy between intellectual ability and achievement as the definition of severe discrepancy level (U.S.O.E., 1976), what is the effect of various IQ levels on the calculations of that severe discrepancy level?
2. Using the 50% discrepancy between intellectual ability and achievement as the definition of severe discrepancy level (U.S.O.E., 1976), what is the effect of various CA levels on the calculations of that severe discrepancy level?
3. What are the effects when the formula is applied to pupils currently identified as SLD via the operational criteria used in Florida?
4. If problems exist with the U.S.O.E. (1976) formula, what are some viable alternatives?

To answer these questions, three separate investigations were conducted. The first evaluated the severe discrepancy levels computed for hypothetical children at various age, grade, and IQ levels; the second applied the formula to a sample of SLD youngsters, previously identified using the Florida operational criteria. The third investigation tested an alternative formula against the same criteria applied in the previous two (i.e., simulated and real cases).

Method

Subjects

To test the effects of IQ and CA on the calculation of severe discrepancy levels, a sample of hypothetical cases was prepared. This simulated data included cases with theoretical grade placements of 1.0, 3.0, 5.0, 7.0, 9.0, and 11.0; theoretical IQ scores of 80, 90, 100, 110, and 120; and possible chronological ages of 6-0, 6-3, 6-6, 6-9, 8-0, and so on (n = 102).

A random sample of students (n = 171) identified as SLD based on the Florida operational criteria (see Mercer et al., 1977) and currently receiving services was also selected for study. Demographic data for 41 of these students were not currently available and these subjects were excluded from the sample. The final sample included 91 males and 34 females ranging in chronological age (CA) from 5-1 to 17-3 years ($\bar{X}_{CA}$ = 9-9, SD_{CA} = 2-8). The actual grade placements (GP) ranged from K.0 to 11.2 ($\bar{X}_{GP}$ = 4.4, SD_{GP} = 2.5); the WISC, WPPSI, and Stanford-Binet IQs ranged from 54 to 144 ($\bar{X}_{IQ}$ = 92.5, SD_{IQ} = 15.5); and the measured achievement (ACH) scores ranged from K.6 to 8.1 ($\bar{X}_{ACH}$ = 2.6, SD_{ACH} = 1.4).

Procedure

Investigation 1. Severe discrepancy levels (SDL) using the BEH formula[1] were calculated for each of the cases in the simulation file; the obtained values ranged from 0.1 to 7.1. These SDL values were analyzed with regard to IQ and CA effects by the following procedure:

1. Percentage discrepancies (PD) were calculated for each SDL Using the following formula:

$$PD = \frac{(\text{Grade placement} - \text{SDL})}{\text{Grade placement}} \times 100$$

2. Two levels of PD (less than 50 and greater than or equal to 50) were cross-tabulated with IQ and CA in two separate analyses.

This procedure enabled the effects of IQ and CA on the calculated SDL values to be evaluated at several hypothetical levels; in each case, one of the values (i.e., IQ or CA) was allowed to vary as the other was held constant in computing the SDL.

Investigation 2. Severe discrepancy levels were calculated for each of the sample cases; the obtained values ranged from 0.1 to 5.1. The effects of IQ and CA were evaluated using a similar procedure to that utilized with the simulated data; however, one additional step was completed. The actual achievement scores were analyzed to determine whether at least one was at or below the calculated SDL (U.S.O.E., 1976, p. 52406-52407).

In conducting this analysis, it was observed that the actual grade placement and the theoretical grade placement (CA - 5.5) might be different for children who had failed a grade in school. For this reason, a slightly modified formula of SDL was applied in calculating the percentage discrepancies.[2] The analyses of the sample data, then, were performed twice; first, using identical procedures to those of the simulated data (with the addition of an analysis of actual achievement discrepancies) and second using a modified formula which corrected for grade placement bias. In fact, the second set of analyses enabled the expected learning rates due to intelligence to be considered.

Investigation 3. The previous analyses were repeated using a modified set of formulae.[3] The intent of this investigation was to evaluate the utility of the new SDL formula (ALT) in accomplishing the goals of the proposed U.S.O.E. (1976) regulations; that is, to have the computed SDL represent a 50% discrepancy at various IQ and CA levels.

Results

Investigation 1

Cross-tabulation of the simulation data in terms of the BEH formula reveals a 50% discrepancy between potential academic achievement (i.e., hypothetical grade placement) and severe discrepancy level only at the 100 IQ level. The BEH formula consistently produced discrepancy levels in excess of 50% when IQ scores were less than 100, and less than 50% discrepancy levels at high IQ levels. These results are presented in Table 1, which demonstrates that with age held constant, percent discrepancy decreases as IQ increases. The Chi square test of the relationship between IQ (less than or greater than 100) and percent discrepancy (less than 50 or greater than or equal to 50) was significant ($p < .01$).

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Insert Table 1 about here

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When CA was stratified into one year levels and IQ was held constant, cross-tabulation of age by percent of academic discrepancy did not yield significant differences. For example, the percentage discrepancies calculated from SDL levels for CAs of 8-0, 8-3, 8-6, and 8-9 at 80 IQ were 68, 63, 59, and 55 (all greater than 50); at 120 IQ they were 32, 26, 21, and 15 (all less than 50). As the CA increased within each one year level, the percent discrepancy decreased at all IQ levels; however, the general relationship between high and low IQ values was maintained and the obtained Chi square was non-significant ($p > .01$).

In the theoretical cases, severe discrepancy level was differentially influenced by IQ but not by chronological age.

Investigation 2

Results similar to those from the simulation data were obtained in

the analyses of the sample children. Of the low IQ (IQ < 100) children, 67% had obtained a percent discrepancy of equal to or greater than 50% while only eight percent of the high IQ (IQ > 100) students obtained "severe" percent discrepancies. Percent discrepancy levels did not vary as a function of CA alone.

The results were considerably different when just SDL and IQ were used as the decision-making criteria. When IQ and actual achievement discrepancy were cross-tabulated, the results were evenly distributed; that is, IQ did not differentially influence the achievement discrepancy decision. In other words, whether or not a child was at or below his or her SDL in one or more actual achievement scores (and thereby identified as "SLD") was not a function of IQ. The previous analyses had indicated that whether or not a child had a 50% or greater discrepancy (and thereby identified as "SLD") was highly related to IQ.

The cross-tabulation of CA and SDL produced similar results to those obtained previously; CA and SDL were not significantly related or differentially influential.

These results indicated that if only the calculated SDL was used as a decision-making criteria, approximately 30 percent of the low IQ children and approximately 54 percent of the high IQ children would be misidentified since that SDL is not always 50 percent discrepant.

Similar results were obtained when the expected grade placement correction was included in the BEH formula. In this case, 40 percent of the low IQ children and 68 percent of the high would be misidentified.

Investigation 3

When the ALT formula was applied to the simulation data, percent discrepancies at all IQ and CA levels were exactly 50 percent. All of the

discrepancy percentages for the sample cases were also stabilized at 50 percent.

Since the obtained SDL values were equal to the proposed values at 50 percent, the analysis of the achievement differences can be thought of as a test for the percentage of children presently classified as SLD who would be classified as SLD by the more severe (i.e., proposed 50%) discrepancy evaluation.

In this sample, 55 percent of the low IQ children did not meet the new SLD criteria and 45 percent did qualify; 62 percent of the high IQ children did not meet the criteria and 38 percent did qualify. The relationship between the IQ and qualification was non-significant ($\chi^2 = 0.279$, $p > .01$). Overall, 43 percent qualified and 57 percent did not. It seems that when an appropriate formula is applied, the criteria are indeed severe.

In this sample, chronological age and eligibility were related at a statistically significant level ($\chi^2 = 18.3$, $df = 7$, $p = .01$). From six to 10 years of age, approximately 20 to 30 percent of the children were qualified as SLD; after 10 years of age, over 60 percent were qualified and less than 40 percent were not qualified. The overall percentage not qualified was approximately 60 percent; again, the 50 percent discrepancy level proved to be quite severe.

Discussion

The three investigations in this study focused on several questions with regard to the use of the recently proposed SLD regulations (U.S.O.E., 1976). Each of the questions will be considered in the following discussion.

1. Does IQ have an effect on the SDL values and percent discrepancy as calculated by the US.O.E. proposed formula?

It would appear that IQ is highly influential in its effects on the

obtained severe discrepancy levels (SDLs) and related percentage discrepancies. As IQ increases, SDL increases and percent discrepancy thereby decreases. The SDL values calculated for children with low IQs are considerably more discrepant than those calculated for high IQ children; in fact, no SDL for a high IQ child was 50% discrepant in the simulated data.

2. Does CA have an effect on the SDL values and percent discrepancy as calculated by the U.S.O.E. proposed formula?

It appears that CA operates more as a moderator than as a predictor of the SDL and percent discrepancy levels. When various CA levels were simulated, their effects were negligible compared to those of IQ. As CA increased, SDL increased and percent discrepancy decreased; however, the percent discrepancy remained greater than or less than 50 percent dependent upon the IQ level being considered.

3. What the the effects of applying the proposed formula to currently identified SLD children?

As might be expected, when the proposed formula (or an expected grade level modification formula) was applied to a sample of currently identified SLD children, the same relationships between IQ (and CA) and percent discrepancy were observed.

However, when academic achievement level was measured against the obtained SDL, IQ did not have a differential effect, nor did chronological age. This suggested that if the SDL is calculated (without regard to its discrepant level) and used as a placement or evaluation criterion against which to measure achievement differences, relatively high levels of error can be expected.

4. Can problems identified in the proposed formula be alleviated?

It appears that the following formula may be useful in obtaining

50% discrepancy levels at various IQ and CA levels:

$$SDL = .5\ [\frac{IQ}{100}\ X\ (CA - 5.5)]$$

This formula takes into account the fact that IQ is thought to influence learning rate and that chronological age minus average entry age may be the best estimate of expected grade placement. This formula "weights" the expected grade placement by the IQ and thereby provides an appropriate indicator against which the discrepancy level should be calculated.

In applying this new formula to simulation and "real" data, 50% discrepancies were obtained at all levels of IQ and CA. The actual percentages of presently identified SLD children who also were identified by this formula was relatively small (i.e., 40%); that is, when an appropriate 50% discrepancy level formula is applied, it does identify less children (those with more severe achievement problems). It must be noted, however, that the sample in this study was identified by operational criteria which are quite different than those utilized by most other states; in fact, they were designed to reflect a "two percent cap." This sample may have been more selective as a result of the identification procedure and may thereby not be representative of similar (i.e., SLD) samples elsewhere.

Implications and Issues

The series of investigations reported here deal primarily with an analysis of the proposed U.S.O.E. (1976) formula derived to predict 50% discrepancy levels at varying IQ and CA levels (p. 52407). Since one intent of the formula was to identify a more severe population, the

50% discrepancy notion would appear to be appropriate provided that it is not biased by its inherent factors (i.e., IQ and CA). The results previously reported and discussed have established some doubt with regard to the general utility of the formula (U.S.O.E., 1976) in achieving the stated goals, except for children whose measured intelligence falls exactly at 100.

In order to permit IQ to vary and still maintain the 50% discrepancy goal (as computed from obtained "severe discrepancy levels"), an alternative formula was suggested and applied to the two sets of data used with the U.S.O.E. formula. While this formula (ALT) appears to be a better predictor of the 50% discrepancy criterion, it would seem that several more salient issues have not been addressed by the proposed regulations:

1. Is a 50% discrepancy in achievement appropriate at all age levels? Does a 50% discrepancy for a sixth grade child represent the same qualitativ and quantitative levels of difference as a 50% discrepancy for a first grade child? Horn's work (1941) in deriving an expected achievement formula suggested that one formula may not have been sufficient to account for age level differences. To this end, she suggested several different formulae to be applied as age increases (Lewerenz, 1955). These same formulae could be applied within the current proposed SLD regulations or the unit weight (i.e., 0.5) in the ALT formula could be varied at different ages.

2. Perhaps a more important issue, however, is not the level of discrepancy but the notion that SLD is defined primarily as an academic achievement discrepancy. Although attempts at logically dealing with process variables and/or operationally defining them have not been adequately resolved, they appear to have been completely omitted from the proposed regulations. This implies that the "process" problem has been

solved by omission and again strongly suggests that SLD is only an achievement disability.

The position taken here does not support or refute the nature of process disorders but acknowledges that their functional evaluations have been relegated to unimportance by their omission in the proposed regulations.

3. Even though the regulations were proposed as a means of establishing the "count" for Public Law 94-142, it is probable that the nature of federal guidelines will be taken more literally and thereby be used more explicitly by state and local education agencies. It would seem that cautious interpretation and implementation should be exercised with regard to any "proposed guidelines." Perhaps a range of discrepancies would be appropriate for a period of time, or a request for operational usages of process criteria should be applied to current SLD populations prior to any "statement" or "regulations" being adopted.

4. By placing maximal emphasis within SLD identification on discrepancy scores, the federal regulations and guidelines have ignored the problems inherent in using "difference scores"; that is, the reliability of a difference score is dependent upon the reliabilities of the two tests used to define the difference and the correlation between them. Difference score reliabilities are often lower than the original test reliabilities; Salvia & Clark (1973), and Salvia & Ysseldyke (1978) discuss the use of difference scores in assessment.

5. One final issue concerns the use of a restricted definition in relation to service delivery. By reducing the number of <u>identified</u> SLD children, a restriction by exclusion is being placed on other children who may need services, with the exclusion being based on a set of loosely

defined behaviors. It would appear that a better procedure might be to establish the parameters of a disability (i.e., not just underachievement) and then permit certain degrees of freedom within those parameters for professional educators to assess, identify, and prescribe individualized instructional programs. One might then match identification and treatment procedures and add credence to diagnostic decisions based on levels of treatments that are needed. The more severe the treatment practices, the more likely one is to be considered disabled.

The intent and purpose of this research was to examine procedures for defining discrepancies (especially the SDL formula) from a variety of perspectives. It is anticipated that the results and discussion presented will serve as a stimulus for productive efforts by special educators in service to handicapped children.

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Footnotes

Bob Algozzine is affiliated with the University of Minnesota Institute for Research on Learning Disabilities.

[1]The following is the U.S.O.E. (1976) formula, referred to as the BEH formula:

$$SDL = CA\ (\frac{IQ}{300} + .17) - 2.5$$

[2]Formula for percentage discrepancies using modified SDL formula to include estimate of expected grade placement:

$$PD = \frac{(\frac{IQ}{100})\ X\ (CA - 5.5) - SDL}{(\frac{IQ}{100})\ X\ (CA - 5.5)}\ X\ 100$$

[3]The following is the alternate formulae for SDL and PD, referred to as the ALT formula:

$$SDL = .5\ [(\frac{IQ}{100})\ X\ (CA - 5.5)]$$

$$PD = \frac{[(\frac{IQ}{100})\ X\ (CA - 5.5)] - SDL}{[(\frac{IQ}{100})\ X\ (CA - 5.5)]}\ X\ 100$$

Table 1

Results of Cross-Tabulation of IQ, CA, and Grade Placement in Terms of Percentage Discrepancies

Age	Grade	IQ 80	90	100	110	120
6-0	1.0	90%	70%	50%	30%	10%
8-0	3.0	68%	59%	50%	41%	32%
10-0	5.0	63%	57%	50%	43%	37%
12-0	7.0	61%	56%	50%	44%	39%
14-0	9.0	60%	55%	50%	45%	40%
16-0	11.0	60%	55%	50%	45%	40%

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*As part of its continuation proposal, the Institute was required to prepare these monographs. Because they are part of the proposal, they are not available for general distribution.

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